

# **Monolayer Films of Novel Porphyrin-Based Materials**

B. O'Driscoll and I.R. Gentle (University of Queensland, Australia)

Beamline(s): X19C

Porphyrin molecules are of great interest as potential light harvesting agents due to their strong absorption of light in the visible region. A major step in the preparation of such devices is the assembly of the molecules into large ordered arrays. To accomplish this, monolayers of porphyrin spread at the air/water interface and ordered using a template effect were studied using X-ray reflectivity. Results of these studies show that by changing either the metal template or the porphyrin it is possible to control the orientation of the porphyrin relative to the air/water interface.

The assembly of porphyrin molecules into ordered arrays is an important part of the development of these compounds for future applications, i.e. as light harvesting agents or in non-linear optical devices. In recent years, ordered arrays of porphyrin molecules have been prepared from solutions of pyridyl substituted porphyrin by employing a metal template effect (Figure 1)<sup>1,2</sup>. Furthermore, surface pressure-area isotherms indicate that the same type of ordering could be achieved for monolayers of porphyrin spread at the air/water interface. However, considerable uncertainty exists as to the orientation of the molecules at the interface and to this end it was hoped that reflectivity from such monolayers would provide insight not otherwise obtainable.

Monolayer films of a number of different porphyrins were spread on aqueous subphases containing  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$  or  $\text{Hg}^{2+}$ , and examined by X-ray reflectivity at NSLS beamline X-19C. Initial results suggest that the orientation of the porphyrin can be set parallel to the interface by the use of  $\text{Cu}^{2+}$  as the metal template, while for tetrapyridylporphyrinato zinc on a subphase containing the other ions the results were either inconclusive or suggested orientation of the porphyrin perpendicular to the interface. It therefore appears possible to control the orientation of the porphyrin at the interface by careful selection of metal ion and/or porphyrin compound.

1. Abrahams, B.F.; Hoskins, B.F.; Robson, R.; *J. Am. Chem. Soc.*, **1991**, *113*, 3606-3607.
2. Alessio, E.; Macchi, M.; Heath, S.L.; Marzilli, L.G. *Inorg. Chem.* **1997**, *36*, 5614-5623.

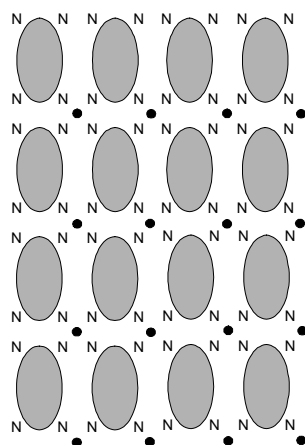


Figure 1 Small black dots represent metal ions, large ellipses are porphyrin molecules